Lancaster Laboratories, Inc.
August 12, 1966

133702

Report of Analysis
West Caln Township Chemical Lagoons

I INTRODUCTION AND GENERAL BACKGROUND

At the request of Mr. William Keene, Solicitor of West Caln Township in Chester County, Lancaster Laboratories Inc. has performed a series of analyses on samples drawn from a chemical lagoon located on the William Dick property in West Caln Township. These samples were taken on the evening on July 21, 1966 with the assistance of Mr. David Mast, members of a volunteer fire company who supplied a ladder truck and in cooperation with a Mr. Johnson and Dr. Bartlet from the Roy F. Weston, Inc. Laboratory, representing Mr. Dick. The dumping site is located on high ground amidst a wooded area in West Caln Township and consists of three separate lagoons with overflows joining them in sequence. All dumping appears to be done into number 1 lagoon which then overflows into number 2 and thence into number 3. Number 3 seems to have been recently dug, is quite large and was just beginning to be filled on the occasion of our visit. Lagoon number 1 is covered with a film of heavy dark oil, perhaps one quarter to three quarters inch in depth, but none of this passes into lagoon 2 or 3 since the overflow draws from beneath the surface of number 1. In the area close to the gate which provides access to the dumping site numerous solid chemicals have been dumped. A quantity of an asphalt like material was noted as well as a white waxy solid.

Using sampling equipment prepared by Mr. Mast according to the writer's instructions it was planned that the ladder truck would be able to suspend the writer out over the surface of the lagoon and that these sampling bottles could then be lowered so as to draw samples from the top, middle or close to the bottom of the lagoon. Unfortunately the fence that surrounds the lagoons kept the ladder truck at such a distance that this method of sampling was not feasible. As an alternate we used the ladder as a sort of giant fishing pole which used with a rope and pulley system allowed us to "cast" weighted sample bottles out into number 1 lagoon. Using this technique the first sample was collected from a point about 30 feet from the edge of number 1 lagoon from the side at which the gate is located. The sample consisted primarily of a milky emulsion with some oil on the surface. The depth of the lagoon at this point is only about 2 to 3 feet with an apparent large accumulation of black sludge on the bottom. Sample number 2 was taken by "casting" to a point considered to be the middle of lagoon 1, the depth here being approximately 8 to 10 feet. Its appearance and physical characteristics were very similiar to sample 1. Sample 3 was drawn by collecting some of the overflow from lagoon 1 to lagoon 2. It was agreeded by all parties concerned that this latter sample was most representative of the milky emulsion

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which lies between the top oily film and the black sludge of lagoon 1 and which makes up essentially the entire contents of lagoons 2 and 3. Sample 4 was obtained by skimming some of the black oil from the surface of lagoon 1. Sample 5 is a specimen of the white waxy solid found on the bank of lagoon 1. Although Mr. Keen was told prior to this sampling that a precise and detailed chemical analysis of the samples would be extremely difficult, time consuming and therefore expensive, it was agreed that a general characterization be made and further that some estimate of the degree of toxicity to living organisms be made. The subsequent sections of this report therefore describe not an exhaustive account of all that we are able to do by way of characterization of these materials, but rather that which was considered appropriate in view of all factors concerned, including the request that the cost remain within modest limits.

II CHEMICAL CHARACTERIZATION OF SAMPLES

A. Samples One, Two and Three

A general chemical characterization of these specimens as industrial wastes was made utilizing standard procedures. The results of these tests appear in Table 1 below:

Table I

Chemical Characterization of Milky Emulsions

Test	Sample 1	Sample 2	Sample 3
pH	4.2	4.2	3.9
Acidity *	22.1	23.18	19.8
Total Solids **	7,400	10,000	5,000
Total Inorganic Solids	6,500	9,000	4,350
Total Organic Solids (by difference)	900	100	650
Chemical Oxygen Demand (COD)	13,900	13,000	7,000

* expressed as meq. of sodium hydroxide required to bring 1 liter of sample to the phenolphtholein end point (pH 8.6).

** all values in remainder of table in parts per million (ppm).

The following interpretations are offered concerning these data: The aqueous phase of the material is fairly high in acid content. This is reflected by the low pH (neutral pH = 7.0) as well as the fact that considerable alkali is required to raise the pH to the phenolphthalein end point. This level of acidity, however, is not regarded as a hazard to distant ground waters since many springs and wells in none limestone areas have pH readings as low as 4.5 to 5.0. In comparison to many industrial

wastes and domestic sewages which we have tested in the past the total solids content in this material is quite high. Expressed on a percentage basis the values are in a range of ½ to 1% of the total sample. The next determination (total inorganic solids) reveals that a large portion of the total solids are inorganic (mineral) in nature. The Chemical Oxygen Demand determination is one which measures the total amount of oxygen that would be required to dissipate those materials in the lagoon possessing reducing properties. Its determination in industrial wastes is the counterpart of the more familiar Biological Oxygen Demand run on domestic sewages. The high values obtained here reflect in part some contamination in samples 1 and 2 with the black oil from the surface of the lagoon, but also reveal the presence of large quantities of oxydizable matter in the emulsion itself. Further interpretation of the significance of these data will be made after the presentation of the biological results.

B. Sample 4, Characterization

Although no work was done on this oil other than the performance of Infra-red analysis, this determination provides quite a bit of information regarding the composition of the material. A photocopy of the Infra-red spectrum is attached to this report. By way of interperation it can be stated that the material is mainly saturated aliphatic hydrocarbon with small amounts of ester components present. These esters are common ingredients of many paint solvents and the like and therefore their presence is not unexpected. Although the material has a slight cresolic odor, the amount of cresol present is very very small, as dictated by the presence of very weak aromatic and phenolic hydroxyl absorption bands.

C. Sample 5, Characterization

Only cursory examination of this white waxy solid was made, since its relevance to the entire situation was not definitely established. An ignition test revealed it to be greater than 99% organic matter. Its Infra-red absorption spectrum is considerably more complex than that of sample #4. Without going into detailed interpretation suffice it to say that the Infra-red data do not contradict Mr. Dick's statement that he thought this to be a cleaning compound. It could well be one of the many nonionic detergents presently manufactured, but this statement shall not be construed to mean that we have established its composition as such. Finally it dissolves in water producing a foamy milky solution that is neither strongly alkaline or acid.

III BIOLOGICAL TESTS

Our biological tests were carried out only on sample #3 which, it will be noted, represented the emulsion of which lagoon 2 and 3 are composed exclusively and which represents the bulk of lagoon 1. Biological tests were made against common bacteria, using tropical fish as test organisms and also using mice. Descriptions of these tests

follow:

A. Microbic Toxicity

Standared bacteriological analysis revealed that sample 3 was essentially sterile. This can be interpreted to mean that in spite of the innoculation which must undoubtedly occur from the environment no micro-organisms are able to survive in the lagoon material. A follow-up test was designed to determine the degree of toxicity to a conventional population of bacteria. A sample of raw mixed whole egg which was previously found to have a bacterial plate count of approximately 25,000 was mixed within one case 10 times its weight of sample #3 and in another case with ten times its weight of sterile water. After standing for 1 hour, comparative bacteriological plate counts were mad e on the two systems. They were found to be no different. Thus it was concluded that the lagoon contents are not highly toxic to microbial life.

B. Fish Toxicity Data

Four Guppies were placed into each of five small fish bowls containing 15,000 ml quantities of conditioned tap water and were allowed to condition for a four day period. After the conditioning period quantities of sample 3 were added to the bowls to provide the following concentration of lagoon material:

Bowl number	Concentration of sample 3 (ppm)
C	.0
1	100
2	1000
3	10,000
4	100,000

The fish were observed for a period of one week after addition of test material. Neither deaths nor abnormal behavior was observed in any of the bowls. The ability of Guppies to survive in the presence of the material, even at a concentration as high as 100,000 ppm clearly indicates that the sample contains no highly toxic component.

C. Mouse Test

Four separate cages were stocked with two adult white mice each which were subsequently conditioned for a period of three days, using a standard laboratory diet and tap water as their liquid source. At the end of the conditioning period one pen was retained as a control group, but the drinking water was replaced in the other three pens with various concentrations of sample number 3 dispersed in tap water. One pen received 0.1% solution, the second pen 1.0% and the third pen received water containing 10% of sample 3. Although water consumption at the high level of adulteration was somewhat decreased as compared to the control, none of the experimental mice showed the slightest physiological abnormality during two weeks under the experimental

conditions. Here again the ability of mice to survive and remain healthy even when 10% of their liquid intake consisted of sample #3 provides strong evidence for the lack of highly toxic ingredients in the lagoon.

V GENERAL CONCLUDIONS AND RECOMENDATIONS

As already indicated the series of tests performed on these samples is not to be regarded as a complete or exhaustive series. Certainly the capability of proceding much further exists were it deamed essential. However, the striking negative values obtained in all three of the biological test systems which were becoming evident as we performed the chemical tests made it seem unneccessary to seek out chemical ingredients of potential high toxicity, since the biological test clearly demonstrated the absence of significant amounts.

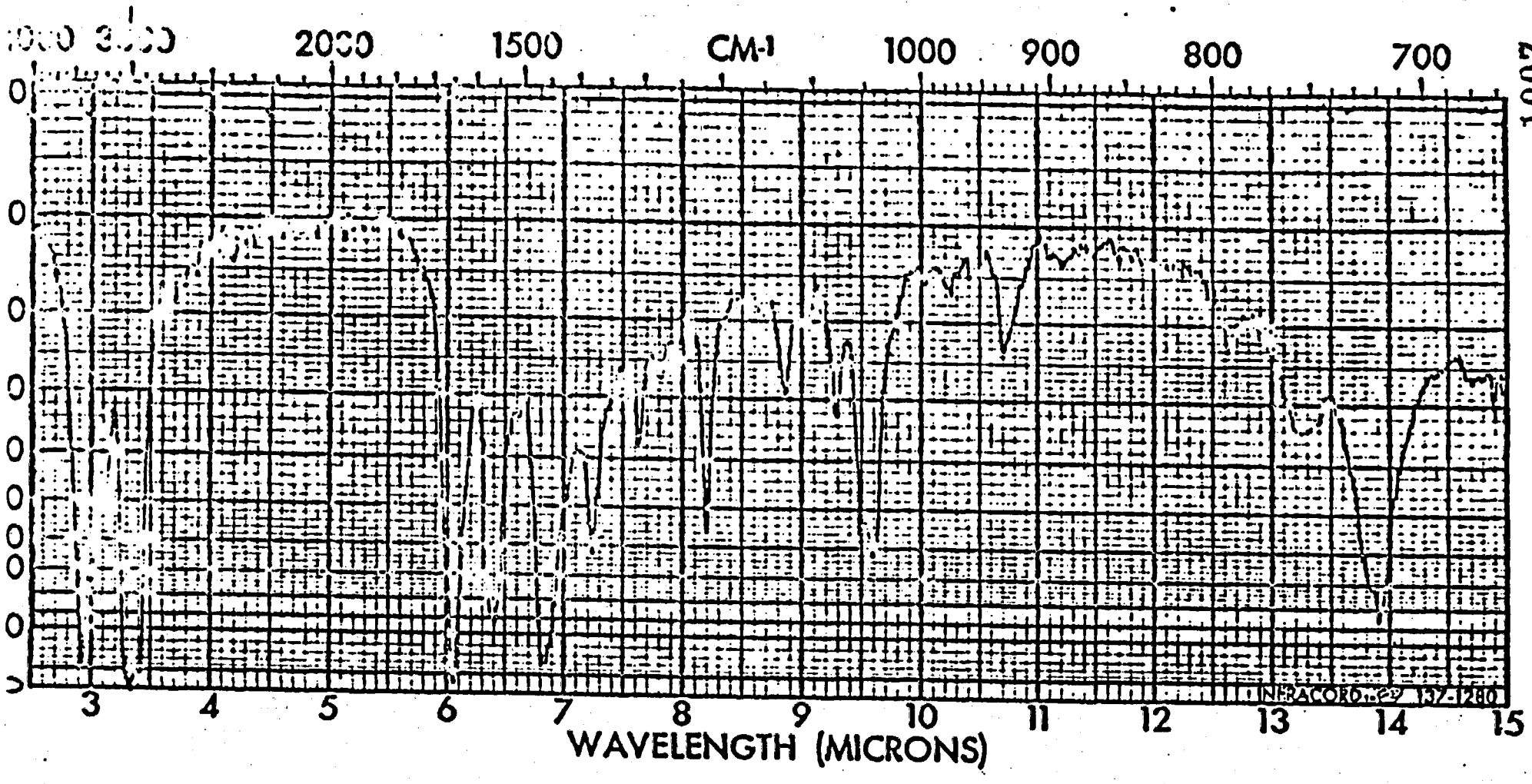
Although our tests would seem to provide solid evidence that the lagoons do not now contain materials that represent a hazard to the ground water supply of the neighboring area, we offer the following suggestions for improvement of the situation and for the future safeguarding of the area surrounding these lagoons. First of all it is noted that the heavy oil film on lagoon 1 represents a definite hazard to flying wild life. Any bird, small or large, alighting in error in this material may well sink into the lagoon or at best could certainly not become airborne again, because of the oily nature of the material. It would not be difficult to install a septic tank-like arrangement containing baffle plates and an oil skimming attachment into which all oil containing waste would be dumped rather than into the lagoon directly. This septic tank would allow the separation of the oily material with the water phase then flowing into the lagoon. Such a system would provide a practical means of avoiding a build up of the thick film of oil on lagoon 1, which in addition to the wild life hazard, completly eliminates the possibility of evaporation from that lagoon. It should also be clearly recognized that these lagoons are not really lagoons in the true sense of the word, since no microbial degradation occurs in them. Thus they might more correctly be termed seepage pits. Material dumped into them can only escape by either evaporation into the air or seepage down into the earth. Since such is the case, we must certainly take steps to insure that so long as dumping is continued into these pits no highly toxic materials will be added to them. Although our present tests show the presence of no dangerous chemicals as of July 21, 1966, without a continued and regular checking of the contents, the township and neighboring citizens rely completely on the integrity and attentiveness of the Leaman Chemical Trucking firm. It is therefore suggested that some agency (the township, the board of health, etc.) establish a program of regular checks of the lagoon contents so as to insure their continued usage under

safe conditions. These tests in our opinion could be relatively simple biological tests, such as those already described in section 4 of this report and would go a long way in insuring concerned citizens that the chemical dumping operation is not posing a hazard to their water supplies.

Respectfully submitted,

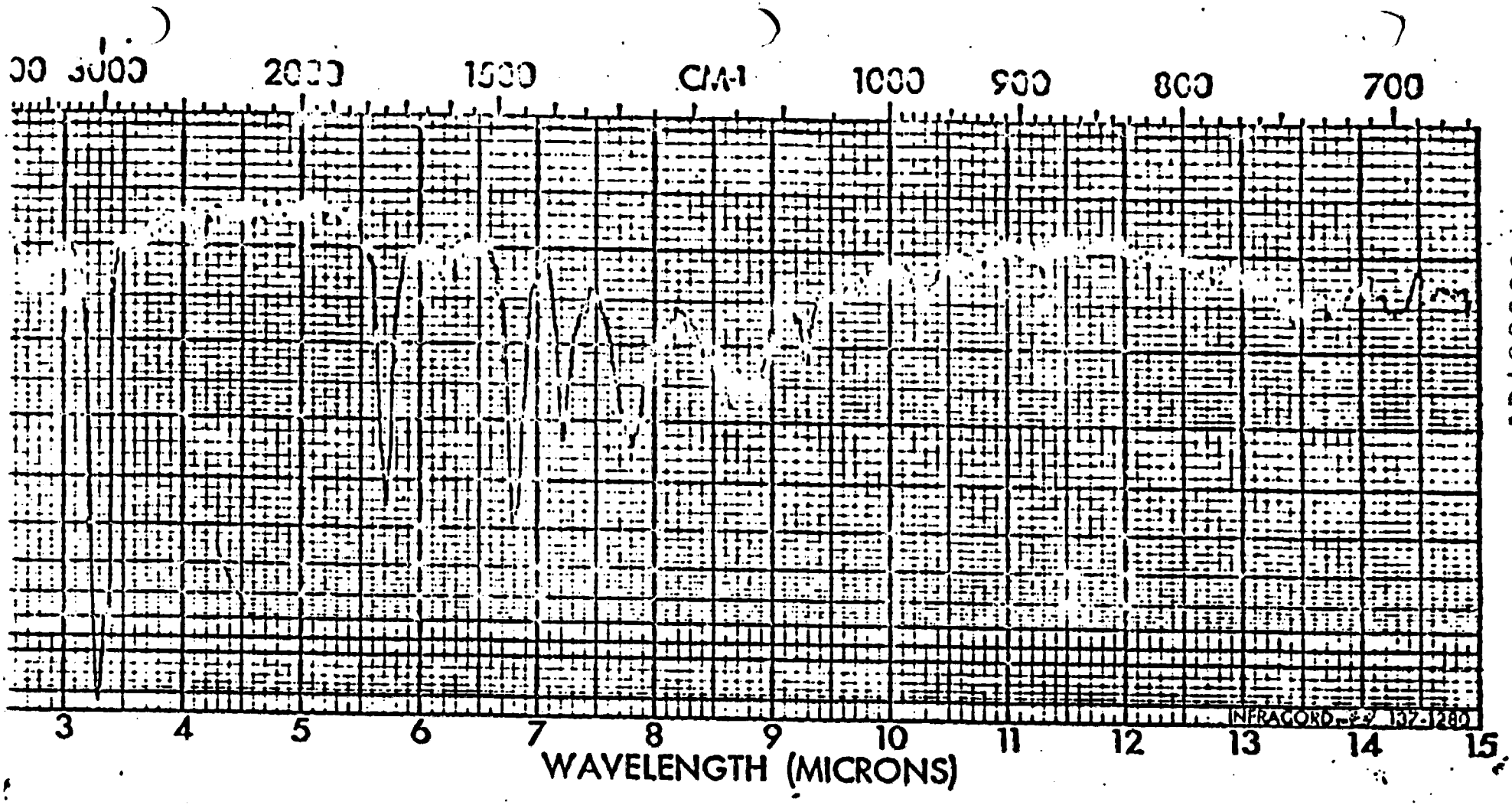
LANCASTER LABORATORIES, INC.

Earl H. Hess, Ph.D.
President



SPECTRUM NO. 22	ORIGIN	LEGEND	REMARKS Higher conc than #21a
SAMPLE #3 Synthetic subl West Caln Township rock	PURITY	1.	
	PHASE Nujol	2.	AR100007
	THICKNESS Thin Film	DATE 8/10/66	
		OPERATOR EAH	

SPECTRUM NO. 22
SAMPLE



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SPECTRUM NO. 21	ORIGIN	LEGEND	REMARKS
SAMPLE "Bunker oil"		1.	Sample Dried for
Surface of west cola	PURITY	2.	several Months
Township Lagoon			
(Sample #4)	PHASE Direct	DATE 8/1/66	Anhy. Na2SO4
	THICKNESS Thin Film	OPERATOR [illegible]	

SPECTRUM NO. 21
SAMPLE "Bunker oil"